TECHNICAL EVALUATION

&

PRELIMINARY DETERMINATION

PROJECT

Draft Air Construction Permit No. 0950203-007-AC

Upgrade of Alstom Combustion Turbine to a Model GT 11NMC

Replacement of Rotor (power) Section and Upgrade of Compressor Components

COUNTY

Orange County

APPLICANT

Orlando CoGen Limited, L.P.

(Operating Agent: Northern Star Generation Services Company, LLC)

ARMS Facility ID No. 0950203

PERMITTING

AUTHORITY

Florida Department of Environmental Protection

Division of Air Resource Management

Bureau of Air Regulation

Air Permitting South

November 19, 2007

{Filename: 0950203-007-AC - TEPD}

GENERAL PROJECT INFORMATION

Northern Star Generation Services Company operates the Orlando Cogen Plant for Orlando Cogen Limited L.P. The plant is a natural gas-fired combined cycle cogeneration facility (SIC No. 4911) located at 8275 Exchange Drive in Orlando, Florida. The existing facility is subject to the following regulatory categories.

Title I, Part C, Clean Air Act (CAA): The facility is located in an area that is designated as "attainment", "maintenance", or "unclassifiable" for each pollutant subject to a National Ambient Air Quality Standard (NAAQS). It is classified as a "fossil fuel-fired steam electric plant of more than 250 million British Thermal Unit (MMBtu) per hour of heat input", which is one of the 28 Prevention of Significant Deterioration (PSD) Major Facility Categories with the lower PSD applicability threshold of 100 tons per year. Potential emissions of at least one regulated pollutant exceed 100 tons per year, therefore the facility is classified as a "major stationary source" of air pollution with respect to Rule 62-212.400, Florida Administrative Code (F.A.C.), PSD of Air Quality.

Title I, Section 111, CAA: As a result of the upgrade discussed herein, the gas turbine and the duct burner are now subject to the New Source Performance Standards (NSPS) in Title 40 of the Code of Federal Regulations (CFR), Part 60, Subpart KKKK which supersedes 40 CFR 60, Subpart GG and 40 CFR 60 and Subpart Dc for this combined cycle unit.

Title I, Section 112, CAA: According to the applications submitted, the facility is not a "Major Source" of hazardous air pollutants (HAP).

Title IV, CAA: The facility operates units subject to the Acid Rain provisions of the Clean Air Act.

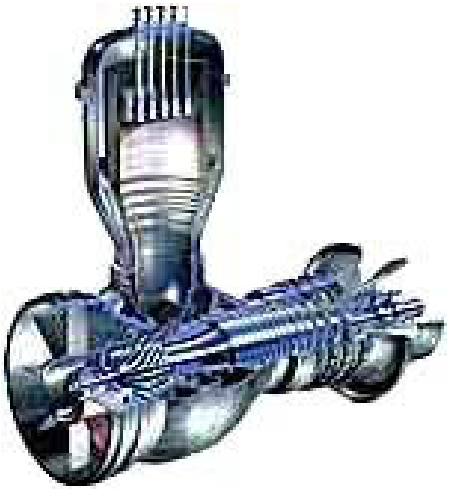
Title V, CAA: The facility is a Title V or "Major Source of Air Pollution" in accordance with Chapter 62-213, F.A.C. because the potential emissions of at least one regulated pollutant exceed 100 tons per year (TPY). Regulated pollutants include pollutants such as carbon monoxide (CO), nitrogen oxides (NO_X), particulate matter (PM/PM_{10}), sulfur dioxide (SO_2), and volatile organic compounds (VOC).

The combined cycle unit was originally subject to a PSD preconstruction review and determination of best available control technology (BACT) in 1992 and constructed in accordance with Permit No. PSD-FL-184. The original project included an Alstom Model GT11N1 (11N1) combustion turbine (CT) designated as Emissions Unit 001 (EU 001). The project also included EU 002 which is a duct burner (DB) located in the heat recovery steam generator (HRSG) to further augment the steam produced from the heat contained in the CT exhaust.

In April 2005 and January 2006, the Department issued Permit No. 0950203-003-AC and 0950203-005-AC to upgrade the CT from an 11N1 to a Model GT 11NM (11NM), increase the maximum heat input to the CT and install an inlet air fogging system.

Most of the power increase results from substantially improved CT cycle efficiency and is achieved with a relatively small increase in fuel input. According to the company, the improvements make it possible to reduce reliance on the less efficient DB to supply the additional energy required by the combined cycle during peak demand.

A diagram of the very similar Model GT 11N2 from www.alstom.com is shown in Figure 1. The potential benefits of the upgrade to an 11NM are clear based on Figure 2.



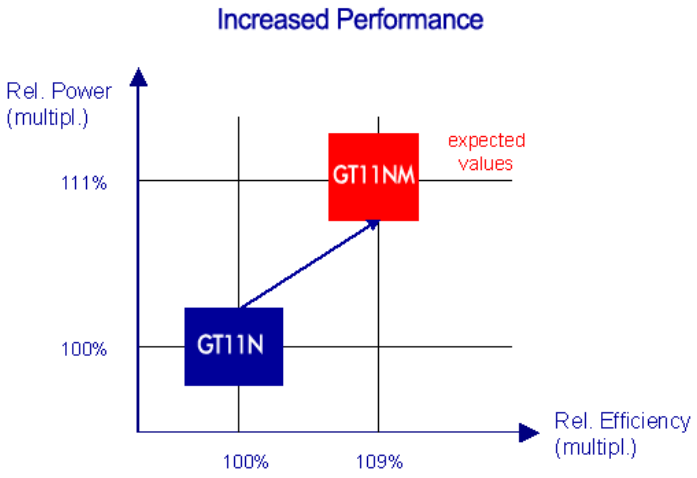


Figure 1. Model GT 11N2 diagram **Figure 2. Benefits of upgrade to Model GT 11NM**

Based on emission projections made during the previous permit evaluation, the project to upgrade to an NM configuration did not trigger a PSD review and a new BACT determination. According to the company, the project has been successful. Usage of the DB has been reduced and the inlet fogging system was not installed. A revised Title V operation permit (Permit No. 0950203-006-AV) incorporating the upgrade to an NM configuration was issued on January 24, 2006.

On August 21, 2007, the permittee submitted an air construction permit application, which is addressed by this Technical Evaluation and Preliminary Determination (TEPD), requesting authorization to further upgrade the existing Alstom gas turbine (EU 001) from an 11NM configuration to a GT 11NMC (11NMC). The upgrade involves the replacement of the CT air compression section with a more efficient one.

The upgrade to an NMC will occur simultaneously with the replacement of the CT rotor (power) section. According to the applicant, the compressor upgrade will consist of the following replacement parts:

- Row #1 – 17 compressor blades;
- Row #1 – 18 inlet compressor guide vanes; and
- Stage #18 filler pieces.
- Improvements to the blow off valve, startup piping and the inlet bell mouth assembly.

According to the applicant, the improved compressor blade design will result in an increase in compressor discharge pressure, which in turn produces an increase in the total mass flow through the turbine. The increase in air flow allows increased fuel firing and power output at approximately the same heat input rate. There will also be less reliance on the less efficient DB during peak demand periods.

According to the applicant, upgrading to a NMC gas turbine will result in a further increase in CT power output, further decreases in DB usage and overall improved cycle efficiency.

KEY APPLICABLE REGULATIONS

National Emission Standards for Hazardous Air Pollutants (NESHAP)

The facility is not a major emitter of HAP. Consequently, 40 CFR 63, Subpart YYYY - National Emission Standard for Hazardous Air Pollutants for Stationary Combustion Turbines does not apply to this combined cycle unit.

New Source Performance Standards (NSPS)

When originally permitted, the CT was subject to 40 CFR 60, Subpart GG – Standards of Performance for Stationary Gas Turbines (Subpart GG). This federal standard and those mentioned below were adopted by reference in Rule 62-204.800, F.A.C. The DB was subject to 40 CFR 60, Subpart Dc - Small Industrial-Commercial-Institutional Steam Generating Units. Subpart (Dc).

Because the project will increase emissions, at least on a short term basis, the CT will be subject to the more stringent 40 CFR 60, Subpart KKKK - Standards of Performance for Stationary Combustion Turbines (Subpart KKKK). Subpart KKKK regulates the emissions of SO_2 and NO_X from stationary CT and associated DB and HRSG with construction or modification commencing after February 18, 2005.

As a result of the newly applicable and more stringent requirements, Subpart GG and Subpart Dc will no longer apply to the combined cycle unit.

The emissions of SO_2 involve the choice of two limits in Subpart KKKK. The SO_2 limit can either be based on mass per gross power output or mass per heat input basis as summarized below:

- 0.90 pounds SO_2 per megawatt-hour gross output (lb/MWH); or
- 0.060 pounds SO_2 per MMBtu heat input (lb/MMBtu).

According to the permittee, the Orlando Cogeneration facility uses pipeline quality natural gas, which because of its low sulfur content of approximately 2.0 grains (gr) per 100 standard cubic foot (scf), will allow the permittee to meet either of these emissions targets with a large margin of compliance.

For NO_X emissions, based on the maximum heat input rate of greater than 850 MMBtu/hr, in Table 1 of Subpart KKKK there is a choice of two emission limits. One limit is based on the NO_X concentration in the effluent gas while the other is based on mass per power output. These two NOx emission limits are summarized below:

- 15 parts per million by volume, dry at 15 percent oxygen (ppmvd); or
- 0.43 pounds per megawatt-hour gross power output (lb/MWH).

The 15 ppmvd NO_X limit listed above is the same numerical BACT limit set in the original PSD permit. However, the permitted emission limit is based on a 24 hour rolling average and applies only to the CT. The Subpart KKKK NO_X emission limit includes both the CT and the DB and is based on a 30 unit day rolling average. Consequently, once the combustion turbine is modified, the facility will have to meet both NO_X emission limits.

DETERMINATIONS WHETHER THE PROJECT CONSTITUTES A MODIFICATION

Modification and Permitting Applicability

Per Rule 62-210.200(Definitions), F.A.C., a modification is defined as follows:

"Modification" – Any physical change in, the method of operation of, or addition to a facility which would result in ***an increase in the actual emissions*** *of any air pollutant subject to regulation under the Act, including any not previously emitted, from any emissions unit or facility.*

(a) A physical change or change in the method of operation shall not include:

1. *Routine maintenance, repair, or replacement of component parts of an emissions unit; or*
2. *A change in ownership of an emissions unit or facility.*

(*b) For any pollutant that is specifically regulated by the EPA under the Clean Air Act, a change in the method of operation shall not include an increase in the hours of operation or in the production rate, unless such change would be prohibited under any federally enforceable permit condition which was established after January 6, 1975.*

(c) For any pollutant that is not specifically regulated by the EPA under the Clean Air Act, a change in the method of operation shall not include an increase in the hours of operation or in the production rate, unless such change would exceed any restriction on hours of operation or production rate included in any applicable Department air construction or air operation permit.

The upgrade from an 11NM to an 11NMC is a physical change and it is not routine maintenance, repair or replacement of component parts of an emissions unit.

Per Rule 62-210.200(11), F.A.C., a "Actual Emissions" is defined as follows:

"Actual Emissions" – The actual rate of emission of a pollutant from an emissions unit as determined in accordance with the following provisions:

(a) In general, ***actual emissions*** *as of a particular date shall equal the average rate, in tons per year, at which the emissions unit actually emitted the pollutant during a consecutive 24-month period which precedes the particular date and which is representative of the normal operation of the emissions unit. The Department shall allow the use of a different time period upon a determination that it is more representative of the normal operation of the emissions unit. Actual emissions shall be calculated using the emissions unit's actual operating hours, production rates and types of materials processed, stored, or combusted during the selected time period.*

(b) The Department may presume that unit-specific allowable emissions for an emissions unit are equivalent to the actual emissions of the emissions unit provided that such unit-specific allowable emissions limits are federally enforceable.

(c) For any emissions unit that has not begun normal operations on a particular date, actual emissions shall equal the potential emissions of the emissions unit on that date.

Any comparison of recent actual emissions per (a) above with allowable or potential emissions per (b) or (c) above will result in an increase of emissions. Additionally, the applicant acknowledges that there can be short term emissions increases from the CT associated with the upgrade. This meets the definition of modification at 40 CFR 60, Subpart A – General Provisions (Section 60.2, Definitions), also adopted at Rule 62-204.800, F.A.C.

Based on the foregoing analysis, the project to upgrade the 11NM to an 11 NMC constitutes a modification with respect to the Department's rules and requires a construction permit in accordance with Rule 62-210, F.A.C.

Major Modification and PSD Permitting Applicability

It is also necessary to determine whether the modification is subject to the Department's PSD rules at 62-212.400, F.A.C. The requirements of Sections 62-212.400(4) through (12), F.A.C., apply to major modifications of existing major stationary source. The key criterion is a comparison of *baseline actual* to *projected actual* emissions. Baseline actual emissions are defined for electric utility steam units at Section 62-210.200(Definitions), F.A.C. as follows:

For any existing electric utility steam generating unit, ***baseline actual emissions*** *means the average rate, in tons per year, at which the unit actually emitted the pollutant during any consecutive 24-month period selected by the owner or operator within the 5-year period immediately preceding the date a complete permit application is received by the Department. The Department shall allow the use of a different time period upon a determination that it is more representative of normal source operation.*

Projected future actual emissions are defined at Section 62-210.200(248) as follows:

"Projected Actual Emissions" – The maximum annual rate, in tons per year, at which an existing emissions unit is projected to emit a PSD pollutant in any one of the 5 years following the date the unit resumes regular operation after the project, or in any one of the 10 years following that date, if the project involves increasing the emissions unit's design capacity or its potential to emit that PSD pollutant and full utilization of the unit would result in a significant emissions increase or a significant net emissions increase at the major stationary source. One year is one 12-month period. In determining the projected actual emissions, the Department:

(a) Shall consider all relevant information, including historical operational data, the company's own representations, the company's expected business activity and the company's highest projections of business activity, the company's filings with the State or Federal regulatory authorities, and compliance plans or orders, including consent orders; and

(b) Shall include fugitive emissions to the extent quantifiable and emissions associated with startups and shutdowns; and

(c) Shall exclude that portion of the unit's emissions following the project that an existing unit could have accommodated during the consecutive 24-month period used to establish the baseline actual emissions and that are also unrelated to the particular project including any increased utilization due to product demand growth; or

(d) In lieu of using the method set out in paragraphs (a) through (c) above, may be directed by the owner or operator to use the emissions unit's potential to emit, in tons per year.

A *major modification* requires a PSD permit and is defined at Section 62-210.200(Definitions), F.A.C. as follows:

"Major Modification" – (a) Any physical change in or change in the method of operation of a major stationary source that would result in a ***significant emissions increase*** *of a PSD pollutant and a* ***significant net emissions increase*** *of that pollutant from the major stationary source.*

Significant emissions rate, for the purpose of determining whether a significant net emissions increase (SNEI) has occurred, is defined at 62-210.200(Definitions), F.A.C. The part of the definition that includes CO and NOx are as follows:

(a) With respect to any emissions increase or any net emissions increase, or the potential of a facility to emit any of the following pollutants, significant emissions rate means a rate of pollutant emissions that would equal or exceed:

1. A rate listed at 40 CFR 52.21(b)(23)(i), adopted by reference at Rule 62-204.800, F.A.C.; specifically, any of the following rates:

a. Carbon monoxide: 100 tons per year (tpy);

b. Nitrogen oxides: 40 tpy;

The significant emissions rates (SER) for CO and NO_X are low compared with the typical annual emissions from combined cycle units. Therefore the possibility of a SNEI for CO or NO_X is a consideration.

The applicant submitted a summary of emissions data for the period 2001-2006. There is some uncertainty regarding the precise five-year period to select for determination of the applicable 24-month period for estimation of baseline actual emissions. This is because a partial upgrade to an 11NM that occurred in 2005 that is being aggregated in the present review with the further upgrade to an 11NMC. Also year 2001 is outside of the five year window. It could still be considered in the revised analysis. The issue is moot because the 24-month period of 2002-2003 has been selected for all pollutants listed in the table below. This period would be available under any scenario.

Table 1. Baseline actual emissions submitted by the applicant (CT and DB combined).

Year of Operation	NO_X (TPY)	SO_2 (TPY)	CO (TPY)	PM/PM_{10} (TPY)	VOC (TPY)
2001	241	2	4	31	14
2002	225	2	3	32	14
2003	240	3	3	33	17
2004	143	2	3	26	15
2005	196	2	3	29	14
2006	198	2	4	31	15
Baseline Actual Emissions (24-month period)	233 (2002-03)	3 (2002-03)	3 (2002-03)	33 (2002-03)	16 (2002-03)

The applicant has projected future actual emissions and based them on the high level of dispatch achieved in 2006. The estimates are shown in the following table.

Table 2. Projected actual emissions submitted by the applicant (CT and DB combined)

Year of Operation	NO_X (TPY)	SO_2 (TPY)	CO (TPY)	PM/PM_{10} (TPY)	VOC (TPY)
Beyond 2008	217	3	4	34	16

Following is a comparison of baseline actual emissions with projected actual emissions to determine the applicability of PSD.

Table 3. Projected actual emissions submitted by the applicant (CT and DB combined)

	NO_X (TPY)	SO_2 (TPY)	CO (TPY)	PM/PM_{10} (TPY)	VOC (TPY)
Baseline actual emissions	233	3	3	33	16
Beyond 2008	217	3	4	34	16
Increase (decrease)	(16)	0	1	1	0
SNEI	40	40	100	25/15	40
Trigger PSD?	No	No	No	No	No

Based on the information submitted by the applicant, the project to upgrade the combustion turbine from a Model GT 11NM to a Model GT 11NMC will not trigger a PSD review or a BACT determination.

The Department concludes that the project does not constitute a major stationary source modification and that a PSD review does not apply and a BACT determination is not required.

DRAFT PERMIT CONDITIONS

The main permit conditions will be to: authorize the replacement of the rotor section; replace key compressor components with improved ones; include the requirements of 40 CFR 60, Subpart KKKK; exempt the facility from the requirements of 40 CFR 60 Subparts GG and Dc; update the emission limits and power capacity rating; and require reporting of future actual emissions. The combined cycle unit shall remain subject to all other valid terms and conditions in the original PSD air construction and Title V air operation permit.

PRELIMINARY DETERMINATION

The Department makes a preliminary determination that the proposed project will comply with all applicable state and federal air pollution regulations as conditioned by the draft permit. This determination is based on a technical review of the complete application, reasonable assurances provided by the applicant, and the conditions specified in the draft permit. No air quality modeling analysis is required because the project does trigger a PSD review.

David Read is the project engineer responsible for reviewing the application and drafting the permit. Additional details of this analysis may be obtained by contacting the project engineer at the Department's Bureau of Air Regulation at Mail Station #5505, 2600 Blair Stone Road, Tallahassee, Florida 32399-2400 or by phone at 850-414-7268.